

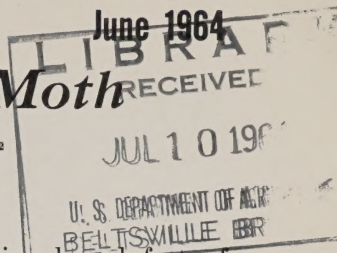
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June 1964

Douglas-Fir Tussock Moth

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The Douglas-fir tussock moth (*Hemerocampa pseudotsugata* McDunnough) is an important defoliator of true firs and Douglas-fir in western North America. Severe tussock moth outbreaks have occurred in British Columbia, Idaho, Washington, Oregon, Nevada, and California; but the complete area subject to attack by the tussock moth is somewhat more extensive (fig. 1). A closely related moth, not yet fully identified or named, has also been destructive in Colorado and Nevada.

Outbreaks of the Douglas-fir tussock moth sometimes develop almost explosively but, after a year or two, may subside abruptly. However, some outbreaks have persisted at low level for as long as 8 years. During a severe outbreak, caterpillars are found crawling over rocks, trees, brush, ground, and animals; but once an outbreak subsides it is usually difficult to find even one caterpillar.

Defoliation by the tussock moth not only retards tree growth but also may kill trees. On the Stanislaus National Forest in California, 60 percent of the white fir trees that were defoliated 90 percent by the tussock moth in 1956 failed to recover. On the Colville National Forest in Washington, in 1929-30, tussock moth larvae killed outright

at least 300 million board feet of fir timber. Many other trees were so seriously damaged that the tops died, or the trees were killed by attacks of other insects. Another outbreak, in 1946-47, covered nearly 500,000 acres of farm woodlots and forest in eastern Washington and northern Idaho (fig. 2). In these and other Western States, infestations have killed as much as 75 percent of the firs on small acreages.

Hosts

This moth has four preferred hosts, and its preference appears to depend on locality. In the central area of its range (Washington, Oregon, and Idaho), Douglas-fir, subalpine fir, white fir, and grand fir are all equally acceptable. In the south (California, Arizona, and New Mexico), white fir is the preferred host. However, in any locality, after the caterpillars have eaten the preferred foliage, they feed on foliage of many other trees and shrubs. Larvae have been found feeding on ponderosa pine, Jeffrey pine, sugar pine, western hemlock, and western larch after the preferred hosts have been stripped. Only California red fir and lodgepole pine have been left untouched.

Evidence of Infestation

Usually the first indication of attack appears in the spring. The hatched larvae feed on new foliage and cause it to shrivel and turn brown. These larvae are so small that they are not easily seen, but by mid-July they are colorful and

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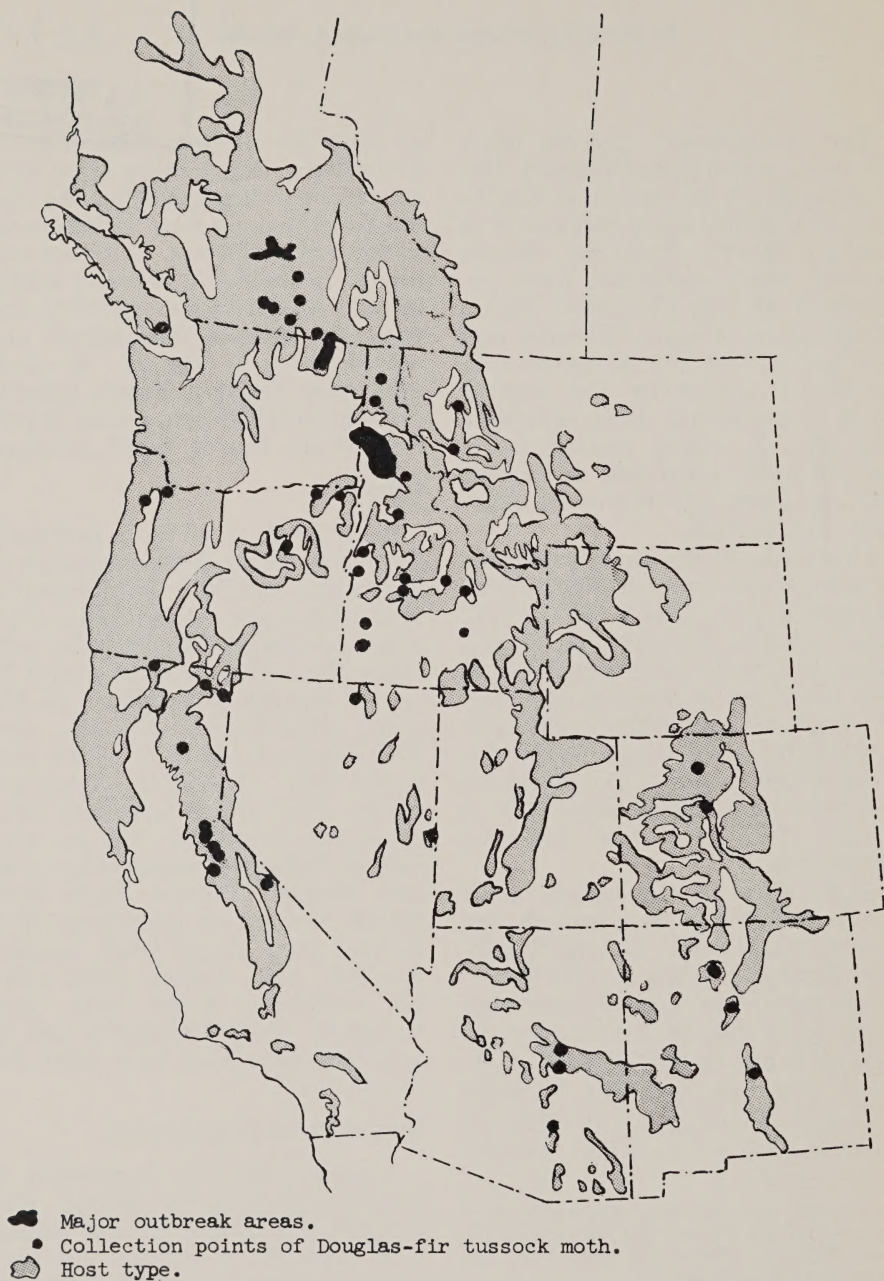
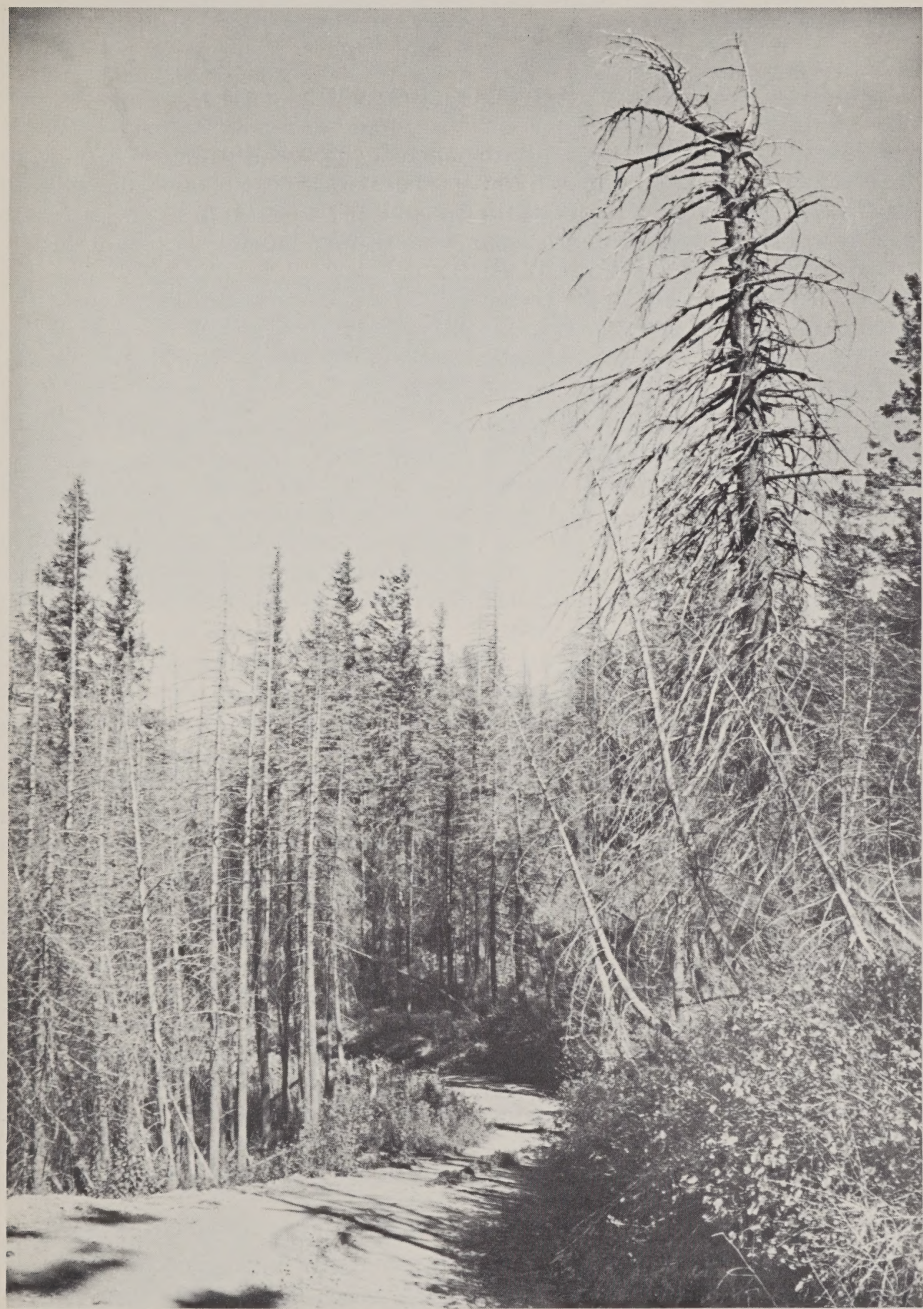


Figure 1.—Distribution of collection points of Douglas-fir tussock moth within the range of host types.



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Figure 2.—Douglas-fir stand killed by the Douglas-fir tussock moth in the 1945–47 outbreak near Moscow, Idaho.

easily visible. They feed on both old and new foliage. They first strip needles from the top and outermost branches; then they feed lower in the crown and farther back on the branches. By August, as the larvae reach pupation, the crowns of most of the firs may be completely bare. Also at this time the large numbers of colorful caterpillars dropping from defoliated trees and crawling almost everywhere confirm the presence of a tussock moth outbreak. The loose webbing produced by the caterpillars as they travel from branch to branch forms a netting that catches and holds pieces of needles dropped as the larvae feed. The brown tips, bare twigs, and dried needle pieces caught in the webbing give the trees a brown, dead appearance.

Description

The male adult (fig. 3, *A*) is an ordinary grayish moth with feathery antennae and a wingspread of 1 to 1¼ inches. The forewings are gray, with two indistinct, irregular dark bars and two vague whitish spots. The hindwings are a contrasting brown. The female (fig. 3, *B*) is very different in appearance, with tiny rudimentary wings, small threadlike antennae, and a large abdomen. She is usually about three-fourths of an inch long and grayish in color; her abdomen is conspicuously darker at the tip because of a dense coat of exceptionally long dark hairs (fig. 3, *C*).

Mature larvae measure up to 1¼ inches long and are very colorful. Two long dark tufts or pencils of hairs similar to horns are located just back of the head; a similar but longer pencil is on the posterior end. Four dense buff-colored tussocks are located forward along the middle of the back (fig. 3, *D*). The rest of the body, except the legs and

head, is covered with short hairs radiating from red buttonlike centers. A sex-connected color variation is notable: the female has a black skin with almost white hairs, but the male has a lighter colored skin with yellowish or buff hairs. These body hairs irritate the skin of some persons; loggers and farmers working in the woods during an outbreak often develop an itching rash from contact with airborne caterpillar hairs.

Life History and Habits

The tussock moth produces one generation each year. Adults appear from late July to early September, depending on season and location.

When the female emerges from her pupal cocoon, her greatly enlarged abdomen contains fully developed eggs. She clings tenaciously to the outside of her cocoon: it is here that she mates and lays her eggs. Cocoons with their attached egg masses usually are scattered on the foliated twigs on the lower part of the tree. Where defoliation is severe, cocoons may be bunched on the trunk, the lower side of larger limbs, or on objects some distance from the tree.

Each female lays her eggs in a single mass (about one-half inch in diameter) of a dry, frothy, gelatinous substance that contains many hairs from her body. She may lay from a few to as many as 250 nearly spherical white eggs in 1 to 3 layers within this mass. She then dies, leaving the eggs to overwinter in the gray, woolly mass attached to the cocoon.

Late in May, after host trees have begun their new growth, the tiny one-eighth-inch, gray, hairy caterpillars begin to hatch (fig. 4). Their long hair and light weight allow them to be carried by wind.



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Figure 3.—Douglas-fir tussock moth: A, Adult male; B, adult female; C, female after laying egg on cocoon; D, full-grown larva.

Since the female moth does not fly, major dissemination of the population is by windborne larvae. These larvae grow slowly at first, but during their four moults they grow progressively faster and eat proportionately more.

Pupation occurs any time from late July through August inside a thin cocoon of silken webbing mixed with larval hairs. The pupal stage lasts from 10 to 18 days, depending on temperature; then the moth emerges to begin the life cycle again.

Control

Natural control.—The Douglas-fir tussock moth has many natural enemies, including disease organisms, insect parasites and predators, and birds. Probably most important is a virus disease that is capable of wiping out epidemics,

but it may appear only after the trees have been seriously defoliated.

Diseased larvae die in either of two ways. They may dry in place as if they had suddenly become mummified, or their internal organs may liquefy so that the larva falls to the ground or lies drooped over a branch. Disease commonly affects only the mature larvae after they have completed feeding.

The more important insect enemies of the tussock moth are small wasps of the genus *Telenomus*, which are egg parasites, and various ichneumon wasps and fly parasites that emerge from the cocoons. Egg parasitism by *Telenomus* may almost completely destroy individual egg masses and may destroy as many as half of the eggs in an infested area. One species of fly, *Pseudosarcophagae affinis* (Fall.), para-

sitized two-thirds of the cocoons during an outbreak in eastern Washington forests in 1955.

Chemical control.—When fir defoliation becomes serious and the landowner cannot afford to lose either growth or trees by waiting for natural controls to operate, he can use chemical control measures.

Small outbreaks involving only a limited number of trees, as on a farm woodlot, often can be sprayed effectively with any ground equipment. This might be a sprayer or mist blower, capable of reaching the tops. However, if an outbreak extends over more than a very few acres or if many trees are too tall to be covered by ground equipment, aerial application is usually more practical.

Two formulations that have proved effective for ground spraying are as follows: (1) 2 pounds of

50-percent wettable DDT powder mixed in 100 gallons of water, and (2) 1 pound of wettable lindane mixed in 100 gallons of water. Either of these may be applied to infested trees until the crowns are wet but not dripping.

The formulation used for aerial spray is 1 pound of actual DDT dissolved in 1 quart of solvent; this quart of concentrate is then added to 3 quarts of diesel oil. The mixture is sprayed at the rate of 1 gallon per acre.

Sprays should be applied as soon as possible after the larvae hatch. Once the larvae are full grown, spraying should be postponed until the following spring.

Caution: DDT and lindane are poisonous to humans, fish, and wildlife. Store them in plainly labeled containers, away from all food. Follow directions and heed precau-



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FIGURE 4.—Hatching tussock moth larvae on egg mass.

tions given by the manufacturer. In forest spraying, avoid overdosing, especially near or over ponds and lakes, and when flight lines cross streams.

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